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Review Article

Social contribution of forensic odontology in Japan[☆]

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ABSTRACT

Half a century has passed since the department for education and research on forensic odontology was established at dentistry-related universities in Japan in 1964. In order to meet the demands of society, the number of universities with a department of forensic odontology increased up until around 2005. In 2007, the Japanese Society of Forensic Dental Science was established, and then a series of reforms such as establishment of the Study Council on Death Cause Investigation in both the National Police Agency and the Cabinet Office of the Japanese government, cabinet decision of enactment and enforcement of new laws on death cause investigation, publication of an article on the Model Core Curriculum of Dental Education, publication of the results of a fact-finding survey on education and research on forensic odontology conducted by the Ministry of Education, Culture, Sports, Science and Technology, inclusion of questions about forensic odontology in the National Board Dental Examination, and compilation of a database on dental findings by the Ministry of Health, Labor and Welfare, proceeded in succession. We introduced the half century of forensic odontology in Japan in chronological order.

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1. Introduction

Japan has experienced many mass disasters such as major earthquakes and fires that resulted in massive numbers of victims. In

addition, a number of unidentified corpses have been found every year. The identification of corpses is very important, as it contributes to peace and order in the society while preserving the individual's dignity. However, among the dead bodies with diverse features, there are cases where death from crimes is overlooked. Therefore, improvement of the death cause investigation system has been required. The fact that forensic odontology is useful for dead body identification has been well known to the public, and the government has also emphasized the importance of this academic field. Forensic odontology, whose main research theme is dead body identification, has drastically changed since 2007. In the process of reviewing the existing death cause investigation system, we thought that the new national law that aimed to develop a forensic odontology education and research base, foster human resources for forensic odontology and create a database of dental findings of citizens, was extremely rare considering other laws that have been enacted.

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Therefore, we would like to introduce the half-century footprint of forensic odontology in Japan, focusing on the study group on cause-of-death investigations at the Cabinet Office, the Cabinet decision on the plan to promote cause-of-death research, and incorporation of questions on forensic odontology into the National Board Dental Examination.

2. Birth of forensic odontology

Yasutami Kojimahara introduced forensic odontology to Japan. In 1894, he translated a paper entitled “Dental Jurisprudence” written by CG. Garrison of the United States and published the translated paper entitled “*Saiban Shika-gaku*”, in which the title means “Dental Jurisprudence” in Japanese representing the dentistry used in trials [1]. In the publication, examples of identification of burned bodies based on dental findings were introduced. In 1899, Umejiro Yamamura of the *Takayama Shika Igaku-in* (currently Tokyo Dental College) delivered a lecture entitled “About Forensic Odontology” (“*Shika-hoi-gaku ni tsuite*” in Japanese) at *Kokka Igakkai* (“*Kokka Igakkai*” in Japanese; This terminology was another word for forensic medicine), and mentioned that the presence or absence of tooth decay, filled teeth and dentures should be completed as dental findings. Yamamura first used the word “*Shika-hoi-gaku*”.

In 1900, Hideyo Noguchi, a research assistant in the Institute for Infectious Diseases, gave a lecture on forensic odontology at *Tokyo Shika Igaku-in* (currently Tokyo Dental College) for the first time. He also translated works of Oscar Amoëdo, who is the founder of forensic odontology, and introduced the papers entitled “Age and Forensic Odontology” and “Forensic relationship of bite wound” into Japan.

In February 1960, volunteers including Kazuo Suzuki (Department of Oral Surgery, Tokyo Dental College) and Katsuiichi Yamamoto (Researcher of the National Research Institute of Police Science) established the Forensic Odontology Symposium (*Shika-hoi Danwa-kai*) in Japan. In June of the same year, Professor Tanemoto Furuhashi (Department of Legal Medicine, Tokyo University School of Medicine) gave a special lecture entitled “Importance of Forensic Odontology” at the first academic conference.

3. Foundation of education research department

As to departments for education and research on forensic odontology in dental colleges, the Forensic Odontology Laboratory (Kazuo Suzuki, Associate Professor; currently Department of Forensic Odontology and Forensic Anthropology) at Tokyo Dental College, and Department of Legal Medicine (Satoru Mukai, Part-time Lecturer) at the Nihon University School of Dentistry were founded in April 1964 and May of the same year, respectively. Furthermore, the Department of Forensic Medicine (Katsuiichi Yamamoto, Professor; currently Department of Disaster Medicine and Dental Sociology, Division of Forensic Odontology) was established at Kanagawa Dental University in April 1968. Yamamoto published the book entitled “*Shika-hoi-gaku* (Forensic Odontology)” in 1963 in Japan. This book was translated and published in the United States four years later [2].

4. An aircraft accident that made forensic odontology well-known

In August 1985, there was an aircraft crash that killed 520 people in Gunma prefecture [3]. Groups of two dentists were engaged in oral examinations of each dead body at the postmortem

inspection station. After one dentist observed the dental findings and the other made a record, then they switched roles and performed the same work. A dental data room was set up in the temporary morgue for the dead bodies, and the postmortem odontograms and the information on dental practice before death were collected. After that, our laboratory examined the propriety of matching using a personal computer, and in 2006, a part-time lecturer, Tomio Miyazawa, created matching search software (which was utilized in the 2011 Great East Japan Earthquake. Cited reference: described later). Of the 520 dead bodies, 233 (45%) were identified by a combination of dental findings and other findings. Two hundred forty-seven (48%) were identified by fingerprints and other findings, and 203 (39%) were identified by blood types and other findings. Thus, dental findings were also well known to the public as being useful resources for identification of dead bodies.

In Gunma Prefecture, the first police medical association in Japan was established with doctors and dentists in February 1984. Currently, police dental associations have been established in all dental associations of the 47 prefectures. Police dentists work in three groups in emergency situations. For each dead body, the first group takes photographs of the face and oral cavity of the body, observes dental findings, and takes intraoral radiographs to prepare a postmortem odontogram according to the Ryan method [4]. The second group prepares an odontogram based on the dental practice information before death. The third group performs matching based on the odontogram and radiographs obtained before and after death.

5. Addition of the department for education and research

Cases involving fatalities due to mass disasters and crimes occur frequently in Japan, and opportunities for identification of dead bodies based on dental findings are increasing. In order to meet the demands of society, dental universities have established new institutes for education and research on forensic odontology in succession. In May 1998, the Center of Legal Medicine of Dentistry (Tamiyuki Tsuzuki, Professor; currently Department of Forensic Dentistry, Nippon Dental University School of Life Dentistry) was opened at Nippon Dental University School of Dentistry in Tokyo. In April 2000, the Department of Forensic Dentistry was established in the Graduate School of Medical and Dental Sciences at the Tokyo Medical and Dental University, and Dr. Kouichi Sakurada was inaugurated as the Professor of this department in March 2015. Then, the Forensic Odontology Center (Yoshifumi Tajima, Associate Professor; currently Division of Forensic Odontology) was opened at Meikai University School of Dentistry in November 2003, and the Department of Forensic Medicine and Dentistry (Keita Sato, Assistant Professor) was established at Tsurumi University School of Dental Medicine in April 2004.

6. Identification of war dead remains by DNA typing

In April 1999, the Ministry of Health, Labor and Welfare set up a DNA appraisal technical committee for the war dead remains. It was a committee to discuss the appraisal samples and methods. Professor Komuro was elected as a member because the appraisal sample was expected to use teeth. In March 2001, a report (*Senbotsushaikotsu no DNA kantei ni kansuru kentokai hokokusho*) was submitted, and in May of the same year, DNA expert conference was held for the remains of the war dead. In April 2016, act on promoting the collection of the remains of war dead (*Senbotsusha no ikotsushushu no suishin ni kansuru horitsu*) was enacted and is still vigorously implemented. Professor Komuro has been an appraiser for 17 years since July 2002.

7. Establishment of the Japanese society of forensic dental science (JSFDS)

In April 2007, the Japanese Society of Forensic Dental Science (JSFDS) was established with over 750 members [5]. The first president of the society was Professor Komuro of Nihon University School of Dentistry. The five activities of this society are as follows: (1) promote the contribution of police dental activities to police administrations, (2) develop a methodology for identification of dead bodies by promoting forensic odontological research, (3) prevent recurrence of medical accidents by analyses of bioethics, medical-related deaths and medical litigation issues, (4) introduce questions on forensic odontology to the National Board Dental Examination, and (5) construct laws and medical policies related to dental practice. The JSFDS opening ceremony and the meeting commemorating the establishment of the JSFDS, the latter of which was headed by Professor Komuro, were held in April 2007.

8. The first appearance of forensic odontology in the educational guideline for dental medicine (EGDM)

The Educational Guideline for Dental Medicine (EGDM), which describes the education contents necessary to train dentists, was revised in June 2008. In this revised edition, the chapter entitled “Forensic Odontology Field” was newly added under social dental medicine. The contents of the teaching included 14 items such as postmortem changes, injury, asphyxia, poisoning, identification of dead bodies by dental findings, blood type and/or DNA type, and medical jurisprudence. Forty-four years have passed since the forensic odontology course was established at the dental university, and for the first time the content of the teaching was informed. Professor Komuro was elected as the organizer of the EGDM.

9. Establishment of “*Shiga kantei shakin-seido* (Honorarium system for tooth identification)”

The Police Act and the Code of Criminal Procedure stipulated that the cost required for criminal identification shall be covered by the treasury of the national government; however, it has been paid in part. The Board of the JSFDS studied how to set up the honorarium system for dead body identification and submitted a request to the National Police Agency in June 2007. In July of the following year, the National Police Agency presented the actual expenses such as making an odontogram, taking radiographs and preparing a certificate etc., and the tooth identification honorarium system was started in April 2009 [6].

10. Deliberation of the diet on forensic odontology

In April 2009, a question-and-answer session on the current status of forensic odontology including education and human resource development for forensic odontology, and the significance of police dentists and their role, based on the basic idea that dead body identification was part of death cause identifications, was held by the Committee on Judicial Affairs of the House of Representatives [7]. The National Police Agency has implemented the honorarium system for tooth identification by police dentists. In addition, the Ministry of Education, Culture, Sports, Science and Technology gave accounts that there were departments for education and research on forensics in six universities; they will consult with the related ministries in order to improve the environment; and they would like to await the fruits of JSFDS's activities. We have no recollection of an instance that forensic odontology had been discussed in the Diet before that. This question-and-answer session influenced the development of the environment around forensic odontology.

11. Re-examination of the death investigation system

Triggered by the discovery of overlooked cases of death caused by crime, the government organized a study group to determine the ideal way of death cause investigation that would prevent overlooking of deaths caused by crime (*Hanzai-shi no minogashiboshi ni shisuru Shiinkyumeiseido no arikata ni kannsuru kenkyu-kai*) in January 2010. The study group consisted of jurists and forensic scientists [including three forensic pathologists, one forensic odontologist (Professor Komuro), and one forensic toxicologist]. At the beginning of the first meeting of the study group, the Chairperson of the National Public Safety Commission mentioned that “I want you to double the current autopsy rate of 10 percent. We want you to consider with a view want you to consider with a view to enact new laws.” After careful deliberation, a report was submitted in April 2011 [8]. In the report, database compilation of dental findings of unidentified corpses, reinforcement of education for dental students and training of dentists in body identification were proposed as future subjects in forensic odontology. In addition, it was also stated that unidentified corpses are subject to coroner's inquest except when it was clearly recognized as death due to a natural disaster, etc., and that the national government would pay an honorarium for tooth identification.

On March 11, 2011, just before submission of the report, The Great East Japan Earthquake occurred. It was expected that the loss of dental practice information due to the tsunami would make identification of bodies difficult. Accordingly, this earthquake has helped to boost the importance of forensic odontology and dental practice information. Of the 15,827 dead bodies excluding missing individuals, 15,767 (99.6%) were identified. Identification of bodies was based on physical characteristics, possessions, etc., in 13,968 people (88.6%), identification was based on the combination of fingerprints and other findings in 373 (2.4%), it was based on the DNA type (including paternity testing) in 2,820 (17.8%) and it was based on dental findings in 1,251 (7.9%). A total of more than 2,600 dentists have been dispatched from all over Japan to confirm their identity [9]. In addition, at the time of screening of dental findings, analysis software developed by Dr. Tomio Miyazawa (Part-time Lecturer at Nihon University School of Dentistry) was used at first [10]. At the time of this earthquake, it was once again recognized that dental findings were useful for identification, and the Ministry of Health, Labor and Welfare is currently holding a study meeting on creating a database of antemortem dental findings (described later).

12. Cabinet decision of death investigation system

In July 2011, then Prime Minister Naoto Kan promoted a new death cause investigation and identification system at the Ministerial Conference on Crime Control, and organized a working team (WT) in close collaboration with relevant ministries. In July 2012, the final report of the WT proposed eight items including the establishment of a forensic autopsy system (provisional name), strengthening of doctor's autopsy system, and improvements in body identification. Currently, the number of corpses handled by police in Japan exceeds 170,000 per year, of which only little more than 20,000 (12%) are subjected to forensic autopsy. If the percentage is raised to 20% as the target rate, it cannot be achieved without doubling the number of autopsy doctors from the current number of 170. In addition, the number of dentists who major in forensic odontology is only about 20. However, there is no doubt that the WT report has made the direction of forensic odontology more solid. That is, this report proposed that (1) dental findings are very important for body identification, (2) education and training in forensic odontology are important for maintenance and

improvement of identification ability, and (3) questions on forensic odontology should be included in the National Board Dental Examination in order to improve the qualification of dentists with ability in forensic odontology.

In October 2012, *Shiin kyumei-to suishinkaigi* (the Council for death cause investigation) was established as a Cabinet Office, and in April 2014, the final report compiled by the Study Committee for death cause investigation was submitted. Professor Komuro was elected to the committee. Then, in June of the same year, the “*Shiinkyumei-to suishin keikaku*(death cause investigation Promotion Plan)” was decided by the Cabinet [11]. In this plan, it was clearly stated that the Ministry of Health, Labor and Welfare would study the method for coding dental findings that would help body identification.

13. Positioning of forensic odontology in two acts related to death cause investigation and body identification

13.1. *Shiinkyumei-to suishin ni kansuru Horitsu (Act on the Investigation of Cause of Death and on Identification of Bodies) (Temporary legislation for 2 years)*

This Act, which came into effect on September 21, 2012, strengthened the system for conducting corpse identification as an urgent issue (Article 1) [12]. The fundamental principle of the identification was specified that informing the bereaved family of “the fact of death” contributed to the respect of life, preservation of the individual’s dignity, and maintenance of the well-being and order of people (Article 2). Furthermore, (1) nationwide preparation of specialized agencies to investigate the causes of death, (2) establishment of centers for education and research on forensic medicine, (3) training of dentists involved in investigating the causes of death and improvement of the qualifications of dentists who want to gain expertise in forensic medicine, and (4) development of a database related to dental findings for identification (Article 6). The enactment of a national law on forensic odontology is an unusual measure. In June 2019, “*Shiinkyumei-to suishinkihonho*” was established at the House of Representatives plenary session, and it will be taken effect from April 2020 [13].

13.2. *Keisatsu-to ga toriatsukau shitai no shiin mataha mimoto no chosa-to ni kansuru Horitsu (Act on the Investigation into Cause of Death or Identity of Corpse by Police)*

This Act came into effect in April 2013 with the aim of preventing the omission of investigation of criminal deaths, because of increased numbers of dead bodies of unknown individuals due to aging and increased solitary living [14]. This Act prescribes that a dead body can be autopsied when the chief of the police station decides that autopsy is necessary based on consultation with a forensic scientist after an explanation to the bereaved family (regardless of the presence or absence of the family’s approval), even if it is an unidentified corpse whose death was not criminal (Article 6). Furthermore, the Act also prescribed that the following targets shall be achieved: (1) cultivation of forensic odontologists and improvement of their qualifications that are useful for body identification; (2) improvement of education and research related to forensic medicine in universities; and (3) development of an investigation system of teeth of corpses (Article 13).

14. Revision of the model core curriculum of dental education (MCCDE)

The Model Core Curriculum of Dental Education (MCCDE) is a summary of the minimum educational content that dental students

should receive before graduation. In January 2011, the Ministry of Education, Culture, Sports, Science and Technology uploaded the interim report on revision of the MCCDE to its website and solicited public comments. In the report, the Ministry stated that it prioritized “matters that were urgent and highly contributing to society among various social needs”, and a policy to focus on “the rapid identification of victims in mass disasters based on information on dental findings.” Public comments that has been submitted were reflected in the edition revised in the 2010 revised edition released in March 2011 [15]. Dental students are required to understand the importance of identification of dead bodies based on dental findings and to be able to explain its significance, as the basic qualities of a dentist in the report. The publication of new MCCDE contents indicates that issues related to forensic odontology will appear as questions in the National Board Dental Examination. It is highly probable that the discussions of the study group that had been organized by the National Police Agency on death cause investigation influenced this revised edition. In addition, due to the enactment of laws and revision of the MCCDE, education and research departments for forensic odontology have been established at 16 out of 29 dental universities in Japan.

15. Field survey on education and research of forensic odontology

The Ministry of Education, Culture, Sports, Science and Technology conducted a field survey on the actual status of education and research on forensic odontology at 29 dental universities in March 2012. The survey might have been conducted to enforce the laws concerning the promotion of death cause investigation and identification, which stipulate that the environment for education and research in forensic odontology should be developed. This survey was continued for several years. Questions included the presence or absence of a forensic odontology course, the presence or absence of a professor of forensic odontology, the number of hours of forensic odontology education, and issues related to cultivation of forensic odontologists. The survey results were published in May 2012 in a report entitled “Field survey of educational research on forensic odontology.” The study revealed a critical situation in which fewer than 20 people are in the forensic odontology teaching profession. In June 2014, the 2014 Annual Meeting of Deans of Dental Schools and Dental-School-affiliated hospitals in national universities was held, and the Medical Education Division of the Higher Education Bureau gave the following comments at the meeting: “Investigation of the cause of death and body identification are pressing issues, and it is important to establish the bases for forensic odontology education and research, to cultivate forensic odontologists and to improve the qualification of dentists who want to gain expertise in forensic medicine. We would like to ask you to actively strengthen the system for investigating causes of death, such as fostering and securing professions and university faculty who would teach dental students and dentists about forensic odontology.”

16. Incorporation of forensic odontology into the national board dental examination

In April 2012, the *Shikaishi kokkashikenseido kaizen kentobukai* (the National Board Dental Examination System Improvement Study Group, i.e., the study group reviewing the National Board Dental Examination System) of the Ministry of Health, Labor and Welfare issued a report demanding to include questions on forensic odontology in the examination starting that year, in view of the reaffirmation of the importance of forensic odontology at the time of disasters. Then, the Dental Health Division, Health Policy Bureau of the Ministry of Health, Labor and Welfare (a division that con-

siders and promotes dental care policy in the Ministry of Health, Labor and Welfare) released the 2014 version of the standards of questions for the National Board Dental Examination, and it was decided that questions on forensic odontology will be included in the examination. It was the moment when one of the goals we set out at the establishment of JSFDS was achieved.

17. Compilation of a database on antemortem dental findings

It was clearly stated that a database of dental findings related to body identification should be developed in the laws on death cause investigation and identification; therefore, the Ministry of Health, Labor and Welfare is currently working on establishment of the database. Health and labor science research is conducted to secure scientific promotion of administrative measures concerning health care and living hygiene of the people and to improve the level of technology. In 2012, Professor Komuro received a Health and Labor Science Research Grant and conducted research on standardization of dental practice information that would help body identification in mass disaster [16]. Based on the results, “*Shika shinryou Jouhou no hyoujyunka ni kansuru kentokai* (meetings on standardization of dental practice information)” and “*Shikashinryojoho no rikatsuyo oyobi hyojunkafukyu ni kansuru kentokai* (meetings on utilization/application of dental practice information and its dissemination)” were held for 3 years from 2013, respectively [17]. The development of matching search software that can be used nationwide will be completed soon, and it will be promoted to compile a database of dental findings of citizens. Dr. Sasajima analyzed the research by Professor Komuro in detail, and reported a screening search method that could complement the defect in dental findings if there are no data or if there are erroneous data on dental findings in the dental record [18].

18. Conclusion

It seems that the need and importance of forensic odontology have been highlighted every time a mass disaster occurred in the past half century, although it is sad to say this. In addition, in recent years, there have been many mass media reports on body identification based on dental findings in cases dealt with by the police, and the close relationship between forensic odontology and society has become more known. Body identification by dentists based on dental findings preserves the dignity of the individuals and has great value in maintaining social peace and order. In response to diverse social demands, forensic odontology is expected to further develop while maintaining its flexibility and consolidating its presence more and more.

Conflict of interest

No potential COI to disclose.

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